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GB 2231188 A US 5621661 A US 4829546 A

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(54) Abstract Title
Programmable loop detector

(57) An inductive loop detector 10 for use in a vehicle control system provides a control facility for controlling the operation of traffic lights and for controlling the operation of booms and barriers associated with access control. In order to accommodate different operating parameters associated with different applications of the loop detector, the loop detector has a non-volatile memory 18 that can communicate with a portable communicating module for down-loading required operating parameters for the loop detector to a microprocessor 16 of the loop detector, the microprocessor serving to control the operating functions of the loop detector.

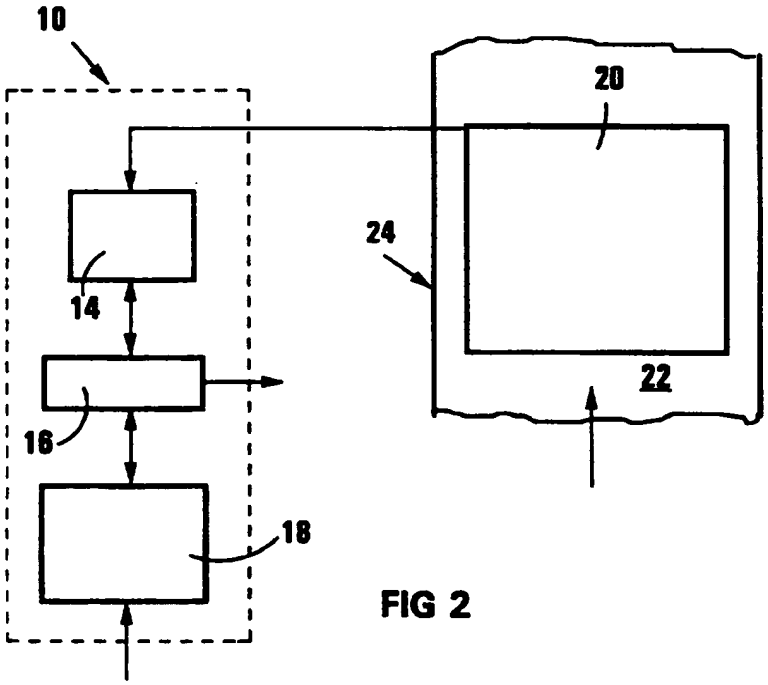

FIG 2

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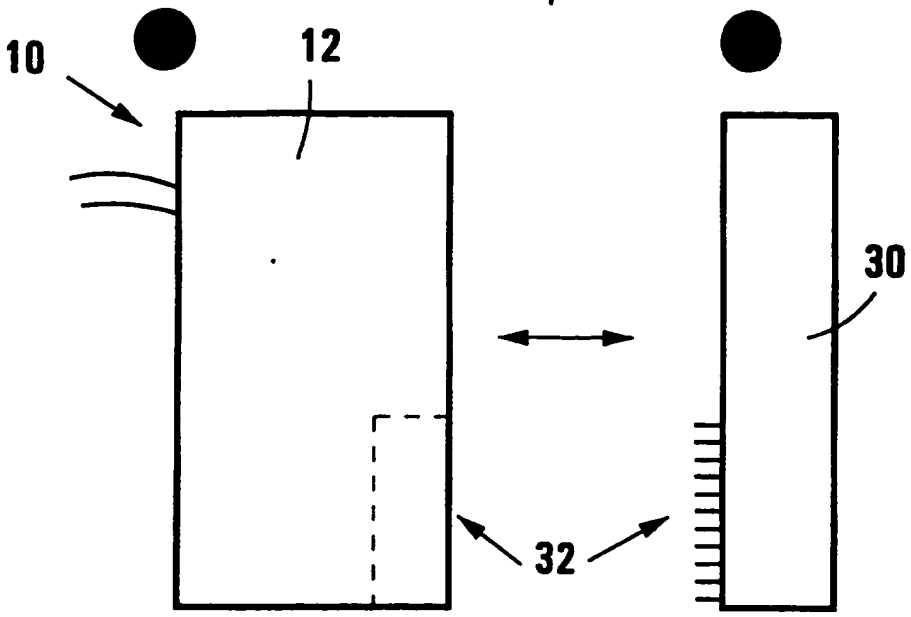

FIG 1

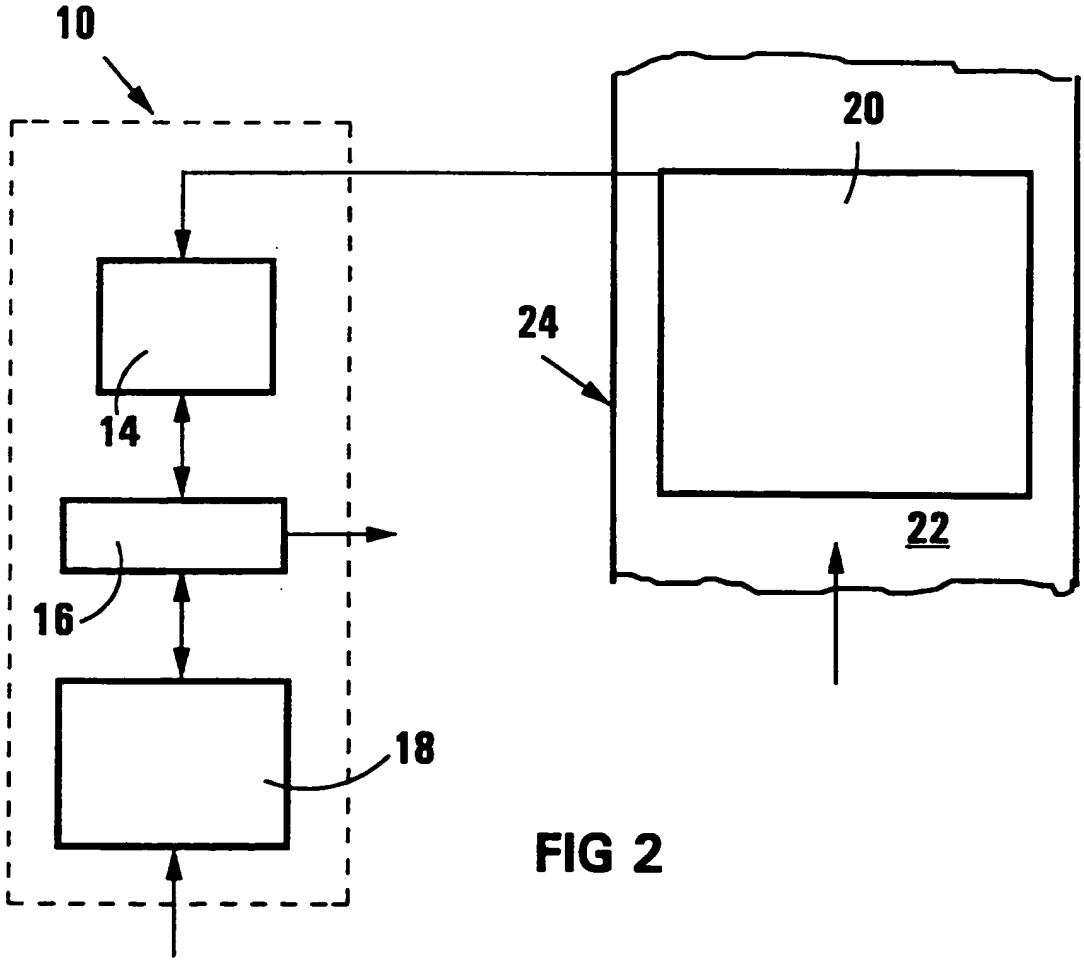

FIG 2

LOOP DETECTOR

THIS INVENTION relates to a loop detector for use in a vehicle control system.

Loop detectors are commonly used in vehicle control systems, particularly control systems that control the operation of traffic lights at intersections and control systems that control the operation of doors, barriers, booms, and the like, associated with access control.

A loop detector, in use, is operatively linked to a wire coil or loop which is laid in a road surface of a roadway in a configuration in which a vehicle passing along the roadway must pass over the coil or loop. An alternating current having a low voltage and frequency is fed through the loop and when a vehicle passes over the loop, the metal content of the vehicle causes a change in the loop inductance, this change in loop inductance being detected by the loop detector, thus effectively detecting the vehicle.

The loop detector, for example, may include an oscillator which can sense a change in frequency associated with a change in loop inductance. A change in frequency of a predetermined magnitude will be indicative of the presence of a vehicle above the associated loop, resulting in an output signal being emitted by the loop detector, most often in the form of a change of state of a relay. A change in loop inductance can be detected and measured also by a shift of phase or a change of signal amplitude, the resulting sensing of the presence of a vehicle permitting the loop detector to initiate other control functions associated particularly with the specific applications of a loop detector.

In relation to different applications of a loop detector, different operating parameters may require setting. For example, where two or more loop detectors are to operate in close proximity to one another, in order to prevent interference with one another the separate loop detectors must be set to operate at different quiescent operating frequencies, known loop detectors being fitted with switches for selecting operating frequencies. Switches also are provided to set the sensitivities of detectors, i.e. the required loop inductive change which will identify the presence of a vehicle, as well as detection hysteresis which allows the inductive change which causes detection to be a different value to that which allows release of the detect condition. It is also important to set the time of holding the detection mode of a loop detector, i.e. the time for which the presence of a particular vehicle should be sensed before which a loop is effectively released to sense a further vehicle, making provision for

situations in which a vehicle may remain stationary above a loop for an undue period of time.

All the above settings conventionally are associated with the setting of a series of switches, or other electro-mechanical setting devices such as potentiometers, which essentially limit variability in the operation of a loop detector and also requires a loop detector always to be easily accessible. When exposed to the environment, the operation of switches, or the like, also can become unreliable and, for the above and other reasons, this mode of setting and operating known loop detectors cannot be considered to be satisfactory in all respects.

Accordingly, it is an aim of this invention to provide an improved loop detector and, particularly, an improved means for setting and controlling the operation of a loop detector.

Any reference hereinafter to a loop detector must be interpreted as a reference to a loop detector of a type to be used within a traffic control system as herein envisaged and having the necessary components and circuitry which permits its required operation.

According to the invention there is provided a loop detector for use in a vehicle control system, which comprises

an oscillator for sensing a change in frequency associated with a change in loop inductance within a loop to which the loop detector can be operatively connected;

a micro processor for monitoring changes in frequency sensed by the oscillator and, in response, for controlling the operation of the loop detector for carrying out its required functions; and

a non-volatile memory that can communicate with a communicating module for downloading required operating parameters of the loop detector to the micro processor, thereby permitting the operation of the micro processor to be controlled.

The loop detector particularly may include plug-in means that can cooperate with complementary plug-in means of a communicating module for permitting communication between the non-volatile memory and the communicating module. Alternatively, the loop detector may include communicating means for communicating through space with a remotely held communicating module, the communicating means thereby permitting communication between the non-volatile memory and the communicating module. In general, it is envisaged that communication between the module and the loop detector may take place with the aid of optical, radio, capacitive, inductive, or infra-red communicating means and

both the loop detector and the communication module will thus incorporate suitable communicating means for this purpose.

Further according to the invention, communication between the non-volatile memory and a communicating module may permit the display of operating parameters, down loaded and existing within the micro processor, by the communicating module. As such, the communicating module may permit the display of operating information of the loop detector as stored by the non volatile memory. It must therefore be appreciated that the communicating module may serve both as a programming and a display module in conjunction with the loop detector of the invention.

The invention extends also to the combination of a loop detector, in accordance with the invention, and a communicating module adapted to communicate with the non-volatile memory of the loop detector.

Still further, the invention extends to a communicating module which is adapted to communicate with the non-volatile memory of a loop detector, in accordance with the invention. This communicating module may be in the form of a portable unit that can communicate with any one of a plurality of loop detectors in accordance with the invention.

Further features of the loop detector of the invention, including the operation thereof and the benefits associated with the use thereof, are described in more detail hereinafter, with reference to the accompanying diagrammatic drawings. In the drawings:

Figure 1 illustrates schematically the outward configuration of a loop detector, in accordance with the invention, and its mode of communication with a communicating module; and

Figure 2 illustrates schematically in block diagram form the operation of the loop detector of Figure 1.

Referring to the drawings, a loop detector, in accordance with the invention, is designated generally by the reference numeral 10. The loop detector 10 includes an outer housing 12 within which there is located in an operatively connected configuration an oscillator 14, a micro-processor 16 and a non-volatile memory 18.

The loop detector 10 is provided for use in a control system that controls the operation of traffic lights at an intersection, the oscillator 14 of the loop detector 10, in its operative configuration, being connected to a wire loop 20 which is laid within a road surface 22 of a roadway 24, particularly in a configuration in which a vehicle passing along the roadway 24 must pass over the loop 20. In use, an alternating

current having a low voltage and frequency is fed through the loop 20 and when a vehicle passes over the loop 20, the metal content of the vehicle will cause a change in the inductance associated with the loop 20, this change in loop inductance being effectively detected by the loop detector 10.

More particularly in the above regard, the change in loop inductance will be associated with a change in frequency in the current passing through the loop 20, this change in frequency being detected by the oscillator 14 and being monitored by the loop detector 10 via the micro-processor 16 operatively linked to the oscillator 14. A predetermined change in frequency will be indicative of the presence of a vehicle above the loop 20 and will result in the micro-processor 16 emitting an output signal in response thereto, this output signal typically taking the form of a change of state of a relay (not shown), which will thus be indicative of a vehicle above the loop 20. Through the monitoring of vehicles passing along the roadway 24 in this manner, the operation of traffic lights at an intersection associated with the roadway 24 can be effectively controlled to thereby permit traffic flow through the intersection to be controlled in a time efficient manner.

The operation of the micro-processor 16 effectively is determined and controlled by the memory 18 and, as such, it is envisaged that different operating parameters can be downloaded into the memory 18 in order to provide for different operating

conditions of the loop detector 10, as determined by the operation of the microprocessor 16.

Specific operating parameters that may require setting include the operating frequency of a loop detector and its associated loop, particularly insofar as interference between loops must be eliminated where two or more loops are to operate in close proximity to one another. Also, operating sensitivities in different situations may require adjustment in order to ensure that vehicles are effectively detected, whereas provision must also be made for situations where a vehicle may become "permanently" stationed above a loop 20, in order to allow effective release of the detection mode of the detector in order to sense further vehicles passing over the loop 20.

The above and any other parameters that may require to be set in relation to the use of the loop detector 10 can be downloaded into the memory 18 by a communicating module 30, a complementary pin and socket arrangement, collectively designated by the numeral 32 in Figure 1, being provided for the communicating module 30 to be plugged into the loop detector 10 in order to permit downloading of variable operating parameters. By permitting such direct downloading of operating parameters, many different working conditions of the loop detector 10 can be accommodated, the memory at all times determining the operation of the micro-

processor 16, which in turn detects the passing of vehicles over the associated loop 20 and allows for output signals to be emitted in response thereto.

Although direct communication via a plug-in arrangement is particularly envisaged, it is also envisaged that the communicating means may take the form of optical, radio, capacitive, inductive, or infra-red based communicating means.

It will be understood also that the same communicating module can be used in conjunction with a series of loop detectors, thus effecting a substantial cost saving in the manufacture of each loop detector. The communicating module also can serve particularly the purpose of a display module insofar as it can provide display means for displaying parameters set, or any other information that can be detected and monitored by a loop detector 10 with which the module can communicate.

With the use of the loop detector 10 and an associated communicating module 30, the conventional setting of switches for controlling the operation of a conventional loop detector is eliminated, providing particularly for greater reliability and a much wider range of operating parameters to be accommodated, while also avoiding the disadvantages associated with the use of switches. Unauthorised adjustment of operating parameters also is eliminated insofar as access to a communicating module will be required for setting the operation of the loop detector, the combination of the loop detector 10 and communicating module 30 also facilitating fault finding in

association with the operation of a loop detector, simply by applying the communicating module and reading programmed diagnostics.

It will be appreciated also that particularly where a communicating module can communicate from a remote location with a loop detector, direct accessibility of the loop detector no longer will be required. Also, the effective operation of the loop detector of the invention is effectively simplified while at the same time making provision for accommodating many different operating conditions and requirements by enabling the adoption of a wide range of operating parameters.

The loop detector as described clearly can be adapted also for all other applications of loop detectors as used in vehicle control systems, e.g. for use in vehicle access systems, and the like.

CLAIMS

1. A loop detector for use in a vehicle control system, which comprises:

an oscillator for sensing a change in frequency associated with a change in loop inductance within a loop to which the loop detector can be operatively connected;

a micro processor for monitoring changes in frequency sensed by the oscillator and, in response, for controlling the operation of the loop detector for carrying out its required functions; and

a non-volatile memory that can communicate with a communicating module for downloading required operating parameters of the loop detector to the micro processor, thereby permitting the operation of the micro processor to be controlled.

2. A loop detector as claimed in Claim 1, which includes plug-in means that can cooperate with complementary plug-in means of a communicating module for permitting communication between the non-volatile memory and the communicating module.

3. A loop detector as claimed in Claim 1, which includes communicating means for communicating through space with a remotely held communicating module, the communicating means thereby permitting communication between the non-volatile memory and the communicating module.

4. A loop detector as claimed in any one of Claims 1 to 3, in which communication between the non-volatile memory and a communicating module permits the display of operating parameters, downloaded to and existing within the micro processor, by the communicating module.

5. A loop detector as claimed in Claim 4, in which the communication between the non-volatile memory and a communicating module permits the display of operating information of the loop detector as stored by the non-volatile memory.

6. In combination, a loop detector as claimed in any one of Claims 1 to 5 and a communicating module adapted to communicate with the non-volatile memory of the loop detector.

7. A communicating module which is adapted to communicate with the non-volatile memory of a loop detector as claimed in any one of Claims 1 to 5.

8. A communicating module as claimed in Claim 7, which is in the form of a portable unit that can communicate with any one of a plurality of loop detectors of the type as claimed in any one of Claims 1 to 5.

9. A loop detector substantially as described in the specification with reference to and as illustrated in the accompanying drawings.

The Patent Office

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Claims searched: 1 to 9

Examiner: A J Oldershaw
Date of search: 27 May 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G1N NDPQ; G4Q QBM, QCJ

Int Cl (Ed.6): G01V; G08G

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2231188A	(WIGGIN) - see e.g. pages 4,5	1 to 9
A	US5621661	(FARROW)	
A	US4829546	(DUECKMAN)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.